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(54) Title: A DOUBLE ACTING STIRRING UNIT

(57) Abstract

In that, in a double-acting stirring unit with a drive shaft (1) and stirring blades (2) placed on this which have been evenly distributed around the drive shaft (1) with which their longitudinal axes from a predetermined angle of 45-90°, where the stirring blades (2) have been placed in a circle and in pairs opposite to each other, where each stirring blade (2) has been rotary embedded around its longitudinal axis as a first axis of rotation, where each stirring blade has been rotary embedded near the drive shaft (1) axis which constitutes another axis of rotation, where the beddings of all the stirring blades (2) in each circle of stirring blades (2) are attached to the drive shaft (1) for rotation along with same around the other axis of rotation, and where all the stirring blades (2) in each circle through a gear wheel (3) each are in mesh with a joint gear wheel, the joint gear wheel (4) is freely rotary embedded around the drive shaft (1) around said other axis of rotation, and that each stirring blade (2) has been rotary displaced in relation to the neighbouring stirring blades (2) and has a cross section at right angles to its longitudinal axis or the first axis of rotation of rounded or angular S-like shape, a stirring unit is obtained through simple means in which the stirring blades are both rotated around the drive shaft and around their own longitudinal axis, a fact causing a compulsory axial and radial transport of the medium which is stirred.

A double-acting stirring unit.

The invention concerns a double-acting stirring unit
with a drive shaft and stirring blades placed on this which
stirring blades have been placed evenly distributed around the
drive shaft with which their longitudinal axes from a
5 predetermined angle of 45-90° where the stirring blades have
been placed in a circle and in pairs opposite each other where
each stirring blade is rotary embedded around its longitudinal
axis as a first axis of rotation, where each stirring blade is
rotary embedded near the drive shaft axis which forms another
10 axis of rotation where all the bedidngs of all the stirring
blades in each circle of stirring blades are attached to the
drive shaft for rotation together with this around the other
axis of rotation, and where all the stirring blades in each
circle through a gear wheel each mesh with a joint gear wheel.
15   The double-acting stirring unit to the invention is
characteristic in that the joint gear wheel is freely rotary
embedded around the drive shaft around said other axis of
rotation, and that each stirring blade is rotary displaced   .
in relation to the neighbouring stirring blades and has a
20 cross section at right angles to its longitudinal axis or first
axis of rotation of rounded or angular S-like shape. Thus, it
is achieved that some of the stirring blades of the stirring
unit will at all times be compulsory rotated by other of the
stirring blades through the joint gear wheel which causes a
25 compulsory axial and radial transport of the medium upon which
the double-acting stirring unit performs its stirring operation.
Due to the rotating movement of the blades, tangential or
round going currents are also generated in the stirring medium.
Said currents also render the use of secondary current
30 breakers redundant in the container in which the stirring
operation is performed, a fact which is particularly
significant when stirring in low viscous liquids.
      Due to the S-like shape, the stirring blades will begin to
rotate around their own axis when the drive shaft rotation
35 commences, and the S-shape is characteristic in that their

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movement through a liquid or through the passage of a liquid
past the stirring blades will offer more resistance than the
liquid flow than on the other side of each stirring blade
rotated against the liquid flow. Further, it is achieved that
5the ratio between the axial and the radial velocities in the
stirring medium may be almost constant so that a change in the
drive shaft number of revolutions will not entail any changes
other than that the liquid velocities and thus the stirring
intensity will change correspondingly. This in turn entails
10that the stirring unit will be equally suitable for high and
low viscous liquids.

        In that the course of each stirring blade has converging
side edges away from its bedding point at the drive shaft, the
rate of flow velocity generated by the stirring operation at
15the particular points of the stirring medium will be more
uniform, i.e. will have less difference than if the stirring
blade side edges were diverging or parallel.

        In that the side edge convergence of each stirring blade
for a particular S-shape and a particular stirring medium has
20been adapted so that the sum of the velocity of each side
edge point around the first and around the second axis of
rotation counting vectorially is constant, it is achieved
that the stirring medium well get the same resulting velocity
throughout the medium touched by the stirring blades, i.e.
25both close to the drive shaft and far from the drive shaft,
thus causing the stirring medium coming into contact with
the stirring medium to get the same energy pulse throughout
the part of the stirring medium coming into contact with the
stirring blades.

30   Due to this even distribution of the energy in the
stirring medium, a comparatively low power consumption is
achieved for the stirring unit in relation to the stirring
intensity occurred.

        In that each stirring blade in a circle of stirring
35blades which may in each circle be in a number of at least
four where the cross section of each stirring blade has been
turned 90° in relation to the neighbouring stirring blade

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cross section positions in a circle of four stirring blades,
and where the cross section of each stirring blade has been
turned 60ᵁ in relation to the neighbouring stirring blade
cross section in a circle of six stirring blades, has been
5 given rotation opposite to the neighbouring blade rotation
through the joint gear wheel, we shall obtain the same uniform
distribution of the stirring intensity but a higher mixing
effect in the area for each circle of stirring blades. The
cross section shape of the blades which when meshing with the
10 joint gear wheel are rotated for instance clock-wise will then
be a reflection of the cross section of shape of the opposite
rotating bladings.

In that the stirring unit has several circles of stirring
blades consecutively placed on the same drive shaft, it is
15 achieved that the stirring unit may be used in containers or
pipes of a high length: diameter ratio with uniform
distribution in the stirring intensity through the entire
length of the pipe section of the container.

The length and S-shape of each stirring blade has, of
20 course, been adapted so that the torque transmitted through
the joint gear wheel in a circle of stirring blades is higher
than the torque required for carrying the other stirring blades
past their rotation dead centre position with a view to the
friction in the meshings for a circle of stirring blades and
25 the friction in the stirring medium.

In cases in which during the stirring operation all the
stirring blades rotate the same way viewed e.g. in their
longitudinal direction towards the drive shaft, it has turned
out that there will be a faint pumping effect from the
30 constantly driving stirring blades in the stirring medium.
This pumping effect in the drive shaft direction may be
increased by mounting several circles of stirring blades
mounted after each other on the same drive shaft with the same
direction of rotation. This phenomenon may e.g. be used in a
35 transport pipe for the stirring medium where the stirring unit
may be inserted with its circles of stirring blades in the
transport pipe, thus generating a mixing operation as well as

a certain amount of moving of the stirring medium in the
drive shaft direction. This faint pumping effect would seem
to cease altogether in cases in which each stirring blade in a
circle of stirring blades has been given rotation opposite the
5rotation of the neighbouring stirring blades through the joint
gear wheel.

    Rather than placing the stirring blades on a joint drive
shaft, the stirring blades may be placed embedded in a joint
pipe, each with its longitudinal axis course radially inward
10and with its gear wheel placed at the pipe wall or possibly
outside it engaged with a crown wheel rotary embedded around
the pipe for transmission of the rotation of the constantly
driving stirring blades to the stirring blades to the stirring
blades driven when a liquid is pumped through the pipe. Thus
15the liquid will be mixed in the pipe during the passage of the
pipe section by the radially placed stirring blades. If so
required, the toothed rim placed around the pipe may be put
into rotation by a motor placed outside the pipe for increase
of the stirring effect of the pipe.

20   The principle of the S-shaped stirring blades and the
joint gear wheel in mesh with the gear wheel of the stirring
blades in each circle of stirring blades may also be applied
in connection with wind or hydraulic power machines for con-
version of the kinetic energy of the wind or of the water into
25mechanical energy. Here, you let the particular S-shaped vanes
be rotary displaced from its neighbouring vane in the circle
where the rotary displacement is +90° in the case of four-vane
circles and +60° with six-vane circles, etc., and where all the
vanes are connected with the joint gear wheel for
30synchronization of their movements and for power take-off of
the mechanical energy generated by the blades. Thus, we shall
get a wind or hydraulic power machine where the blades are
rotary around their own longitudinal axis only, but not around
the take-off shaft axis, thus avoiding the powerful inertia
35forces connected with vanes rotating around the take-off axis.
In that the vanes are also in this case converging from the
joint gear wheel and out towards the tips of the vanes, the

vanes may be dimensioned much easier than usual because it is
not necessary to pay very much attention to the centrifugal
forces which are otherwise usually dimensioning along with the
bending moment of the particular blades. A thus designed wind
5or hydraulic power machine has, unlike conventional driving
engines, no need of adjustment of vanes in relation to the
strength of the wind or the water flow. Conventional systems
are made in such a way that the vanes are being put more and
more on edge with a rising wind force or water flow. The
10interaction between the constantly driving rotary vanes and
the driven rotary vanes will ensure that the resulting moment·
will be constant so that the number of revolutions for the
particular rotary vane will remain constant, even at high wind or
water velocities.The risk of any such driving engine racing is thus
15eliminated. The driving engine should only be cut out when the
wind or water forces become so powerful that they constitute
an excessive action on the supporting structure of the actual
driving engine. At very high wind or water flow velocities,
such that a driving machine may appropriately be designed so
20that two, or a multiple of this, of the rotary vanes may be
put parallel with the others, thus reducing the flow action to
a minimum, and the wind or hydraulic power machine will stop.

In the following the invention is described in more detail
in connection with some type examples and with reference to the
25drawing, in which

Fig. 1 shows a stirring unit with two pairs of stirring
blades which have converging side edges, and which have,
viewed from their free blade end, the same rotation,

Fig. 2 is a side view of the stirring unit shown in Fig.
301, partially in section,

Fig. 3 is a section along III-III in Fig. 1 through a
stirring blade,

Fig. 4 is a stirring unit as a schematic side view with
two pairs of stirring blades having converging side edges, and
35which, viewed from their free blade end, have in one pair
rotation opposite to the blades of the other pair,

Fig. 5 is a stirring unit with circles of stirring blades,

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the beddings of which all rotate together with the drive
shaft, and whose joint gear wheel placed freely rotatable
around the drive shaft axis is in mesh with the gear wheel
of the stirring blades in both. circles of stirring blades,

5   Fig. 6 is a wind or hydraulic power machine in the form
of a windmill from a front view with two pairs of S-shaped
rotor blades stationarily embedded, and whose rotation is
synchronized by the joint gear wheel which also serves as
output shaft from the windmill stationary cap.

10   Fig. 7 is a side view and partial section of what is
shown in Fig. 6,

       Fig. 8 is the drive medium flow around an S-vane in a
position near its dead centre position where it will yield
its smallest torque,

15   Fig. 9 is the S-vane near the position at which it will
yield its highest torque to the joint gear wheel,

       Fig. 10 is an S-shaped stirring blade/vane of the
Savonius type,

       Fig. 11 is an S-shaped stirring blade/vane of the
20 anemometer type, and

       Fig. 12 is a stirring blade with parallel side edges
and a stirring blade with diverging side edges.

       Figs. 1 and 2 show a stirring unit with a drive shaft
1 carrying a single circle of stirring blades 2 of an S-like
25 cross-section shape. Each stirring blade 2 has a gear wheel
3 in mesh with a joint gear wheel 4. All the gear wheels 2,3
are rotary embedded in a bearing housing 5 attached to the
drive shaft 1. Through the drive shaft 1 rotation of the
bearing house and thus of the stirring blade axes 6 in a
30 stirring medium, the stirring medium will, as mentioned
before, due to the S-like shape of the stirring blades 2 give
the stirring blades and thus their gear wheel 3 a rotation in
the bearing housing 5. An example of an S-like blade cross
section is shown in Fig. 3. Other blade cross sections may,
35 of course, also come into the picture as long as their shape
will cause the stirring blade half moved the same way as the
stirring blade axis all times to offer less resistance to its

movement in the stirring medium than the stirring blade half
moved opposite the stirring blade axis direction of movement.
The stirring blade axes 6 constitute the first axis of
rotation of the stirring blades while the drive shaft axis
5:7 constitutes the other axis of rotation.

Other S-like cross section shapes include the anemometer
and Savonius vane blade shapes, see Figs. 10 and 11.

As shown, the bedding of the stirring blades may be alone
in the bearing housing 5 radially innermost but also a
10bedding radially outermost in a round-going ring not shown
which may be appropriate, e.g. for stirring blades with
parallel or radially outwardly diverging edges.

The converting vane edges 8 shown in the drawing are
suitably adapted with such a convergence that the stirring
15blades will give the stirring medium a resulting stirring
pulse which is constant throughout the length of the blade.
This means that the stirring effect deriving from the
stirring blade rotation around the first axis 6 will
decrease in the radially outwards direction whereas the
20stirring effect deriving from the stirring blade rotation
aorund the other axis 7 will increase in the radially
outwards direction.

The convergence is determined by tests with the stirring
medium (media) for which the stirring unit is to be used.
25   The stirring unit shown in Fig. 4 also has uniform
stirring blades 2, 2A, in pairs opposite each other. One pair
of stirring blades 2A has, however, an S-like cross section
shape which is inversed of the cross section shape of the
other pair of stirring blades 2. However, the side edges 8 of
30both pairs are converging in the radially outwards direction.

For synchronization of the four stirring blades 2, the
joint gear wheel 4A has been equipped, e.g. as shown, with two
tooth sides for meshing with the gear wheels 3 for the
stirring blades 2 and 2A, respectively. In that half the
35stirring blades of the stirring unit rotate opposite to the
other stirring blades during the stirring there will be no
appreciable resulting transport of the stirring medium

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parallel with the other axis 2 such as will be the case with
the arrangement shown in Figs. 1-2. In Fig. 1-2, the
stirring medium will, at the direction of rotation shown for
the drive shaft 1 and the blades 2 at the cross section
5 shape shown in Fig. 3, receive a moderate resulting action,
directed downwards in Fig. 2.

Fig. 5 shows two circles of stirring blades 2 on the
same drive shaft 1 where the rotation of the stirring blades
2,2A around the axes 6 is opposite in the two circles. Thus,
10the stirring effect is fully balanced and will not expose
the drive shaft 1 to any appreciable axial power action. If
the joint gear wheel 4B for the two circles gave the
stirring blades of the circles the same direction of
rotation, the pumping effect of the vane mentioned before
15would be increased by the stirring medium in the drive shaft
direction by the number of uniformly rotating stirring
blades.

With a view to optimizing delivery time, the design of
the stirring unit to the invention aims, for the structure
20elements involved, at a stirring blade number of revolutions
at 75-125%, preferably 100% of the drive shaft revolution
number. The drive shaft number of revolutions is determined
by the peripheral speed for the radially outermost ends of
the stirring blades, and this peripheral speed should not
25exceed 20m/sec. When calculating the maximal number of
revolutions of the drive shaft, the rotation of the stirring
blades around the axis 6 is disregarded.

The stirring unit has proved particularly suitable for
mixing dough, powdered, paste-like and generally highly
30viscous masses. Where the stirring unit has radially
outwardly converging stirring blades of of an S-like cross
sectional shape, it has been shown in practice that with the
same mixing effect in a particular stirring medium, you need
only use 10% of the energy consumption which used to be
35attached to the most economical stirring units. Furthermore,
baffle plates in the stirring containers may be saved.

For stirring units with a length-width ratio for the

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stirring blades of 4:1, stirring blades of simple S-like
cross sectional shape may be used, possibly reinforced
centrally by a tubular centre part. With a higher length-
width ratio for the stirring blades, it will be appropriate
5 to compose the blade cross sections from three S-like
surfaces or from a triangle cross section from whose triangle
corners a longitudinal side comes out, e.g. forming an angle
with the adjacebt surface of e.g. 115°.

Due to its design and operation, the double-acting
10 stirring unit will yield a powerful radial pulse to the
liquid, e.g. 8 times per drive shaft rotation, due to the
fact that each of the stirring blades 2 is at right angles
to their guide direction twice per drive shaft rotation at
a stirring blade number of four. It must be assumed that this
15 pulse will be of higher intensity than it would have been
the case if the blades had been mounted fixed under 90° with
the course of the blades. The power transmission between the
stirring blades and the stirring medium would then be lost
in a powerful turbulence in the stirring medium, and this
20 turbulence would soon be braked by the inner friction of the
stirring medium. Unlike this, the double-acting stirring
unit to the invention will generate strong pulses which may
spread further out in the stirring medium, and thus the
number of stirring units may be reduced in comparison with
25 stirring units known so far. This harmonizes with the fact
that the stirring unit to the invention has a higher
specific performance due to the extra rotation movement for
the stirring blades compared to stirring units which have
fixed blades or compulsory rotary blades.
30   Due to the double current principle established by the
rotations around the axis 7 and the axes 6, respectively,
and the undulating current conditions, it would seem that the
double-acting stirring unit is considerably less sensitive
to variations in the diameter ratio between the stirring unit
35 spreading diameter and the diameter of the container in which
one or more stirring units are placed, than conventional
types. Through changes in the number of revolutions and

. possibly in the geometric structure, the double-acting
stirring unit may be brought to work satisfactorily in the
range from 0.1 to 0.9, i.e. that the stirring diameter may

vary between 10 an 90 % of the container diameter. This
5 gives a considerably higher flexibility in the application
of the stirring unit to the invention.

Figs. 6 and 7 show a wind power machine in the form of
a windmill which, as shown, has four rotor blades 2 rotary
embedded around their own axis 6, but which are not rotary
10 around the actual windmill axis 7. Between the rotor blades
7 and a central output shaft 10, there is a mechanical
arrangement which will not only transmit the rotation of the
rotor blades 2 to the output shaft 10, but also to the other
rotor blades. Thus, there will always be a positive drive on
15 the output shaft 10, naturally on condition that the rotor
blades, like in the case of the stirring unit, are rotary
displaced in relation to the neighbouring rotor blades.

The rotor blades 2 are designed in such a manner that the
wind finds it harder to pass at one side of the blade centre
20 line than on the other side. The torque thus generated will
give the rotor blade a rotating movement. Due to this design
of the rotor blades, those of the rotor blades rotated at
all times by the rotor blades driving at all times will have
a particularly low resistance to the wind in the direction
25 of rotation.

The design aimed at for these rotor blades has been
illustrated in Figs. 8 and 9 where the arrows show the wind
direction, where the arrow 11 shows the direction of rotation
for the rotor blade, where plusses illustrate a driving side
30 at the rotor blade and minusses a suction side or suction
effect. When passing over the rotor blade, the kinetic and
static energy in the wind given at the side of the rotor
blade rotating with the wind is converted into pressure energy
at the top side, and by turbulence action into suction effect
35 at the rotor blade bottom side. At the side of the rotor blade
rotating against the wind, the air will be unidirectional.

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as far as possible so that there will be both at the top side
and bottom side of the rotor blade an approximate laminar
flow entailing a poor resistance to the compulsory rotary
movement.

5   The power action on the rotor blade 2 thus obtained will
form a resulting moment which is higher than the moment
required to drive the rotor blades driven due to the
difference aimed at by the design of the blades between .
laminar and turbulent flow along the two blade sides.

10   Any such windmill will not be sensitive to turbulence
 .in the wind. Any such turbulence in the wind will, however,
be used effectively through the rotary movement of the
particular rotor blades. With the windmill, the peripheral
speed for the rotor blades will be decreasing from the axis
15? and out to the tip of the blades contrary to what is the
case with the ordinary windmill types. Due to this, the ....:.
blades may be dimensioned considerably easier than usual
for you do not have to pay very much attention to the
centrifugal forces which are otherwise usually dimensioning
20together with the bending moment of the particular rotor
blades.

       Unlike windmills known so far, the vanes or the rotor
blades at the windmill to the invention do not require
to be adjusted in. relation to wind force. In the known
25windmill systems, the vanes are put more and more on edge
 · at a rising wind force. The interaction between driving and
driven rotor blades at the mill to the invemtion will see
that the resulting moment is constant so that the number
of revolutions for the particular rotor blades remains
30constant, even at high wind velocities.-The risk of the mill
racing has thus been considerably reduced.

       It will only be necessary to disconnect the mill when
the wind forces become so powerful that they constitute
an excessive action on the supportingstructure of the mill.
35At very high wind velocities, it will therefore be appropriate
:that the mill be organized with a mechanical arrangement
entailing that all the rotor blades may be set parallel with

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the wind direction for stopping the mill.

As would appear from Fig. 7, the joint gear wheel 40
for synchronization of the reciprocally displaced rotary
movements of the rotor blades 2 has been attached to the
5 output shaft 10, the rotation of which is transmitted through
a gear transmission 12 down through the vertical supporting
structure 14 of the windmill through a drive shaft 15, e.g.
for the operation of a dynamo or some other energy consuming
equipment. A hydraulic pump may also be in direct mesh with
10 the joint gear wheel 40 so that instead of the output shaft
7, the gear transmisison 12,and the drive shaft 15, hydraulic
lines have been conducted to the hydraulic pump at the joint
gear wheel 40.

Fig. 10 shows a cross section through an S-like cross
15 section through another stirring blade or rotor blade to the
invention of the Savonius type whereas Fig. 11 shows a
stirring or rotor blade cross section of the anemometer type..

Fig. 12 shows that even though a stirring blade or rotor
blade 2 of converging shape is highly advantageous to the
20 invention, also blades 2 of parallel and diverging shapes
will be appropriate for certain applications, e.g. when you
do not require a uniform mixture throughout the stirring unit
range but e.g. want a heavier mixture at the vane tips.

PATENT CLAIMS:

1.   A double-acting stirring unit with a drive shaft (1) and
stirring blades (2) placed on this which have beenplaced
evenly distributed around the drive shaft with which their
longitudinal axes form a predetermined angle of 45-90°,
5 where the stirring blades have been placed in circles opposite
each other, where each stirring blade has been rotary embedded
around its longitudinal axis, as a first axis of rotation,
where each stirring blade has been been rotary embedded near
the drive shaft axis which constitutes another axis of rotation
10where all the beddings of the stirring blades in each circle of
stirring blades are attached to the drive shaft for rotation
together with this around the other axis of rotation, and
where all the stirring blades in each circle through a gear
wheel (3) each mesh with a joint hear wheel, characterized in
15that the joint gear wheel (4) is freely rotary embedded around
the drive shaft (1) around said other axis of rotation, and
that each stirring blade (2) is rotary displaced in relation
to the neighbouring stirring blades and has a cross-section at
right angles to its longitudinal axis of rounded or angular
20S-like shape.

2.   A stirring unit according to claim 1, characterized in
that the course of each stirring blade has converging side
edges away from its bedding place at the drive shaft.

3.   A stirring unit according to clam 1 or 2, characterized
25in that the side edge convergence of each stirring blade (2)
for a given S-shape and a given stirring medium has been
adapted so that the sum of the velocity of each side edge
point around the first and around the other axis of rotation
counting vectorially is constant.

304.   A stirring unit according to one or more of the preceding
claims, characterized in that each stirring blade in a circle
of stirring blades has been given the opposite rotation of
the neighbouring stirring blades throught the joint gear wheel.

5.   A stirring unit according to one or more of the preceding
35claims, characterized in that it has several circles of

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stirring blades placed consecutively on the same drive
shaft.

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Fig. 1.

Fig. 3.

Fig. 2.

Fig. 4.

Fig. 5.
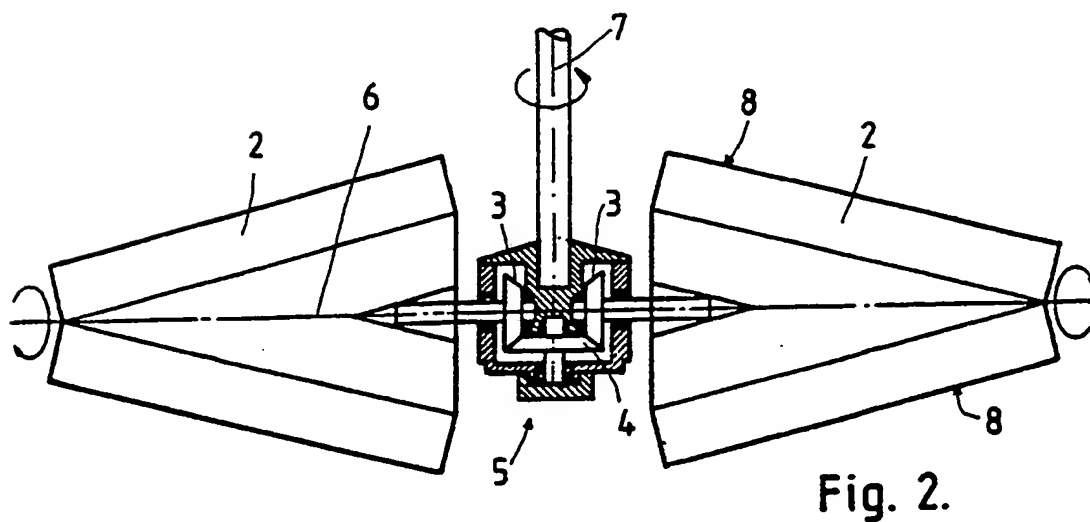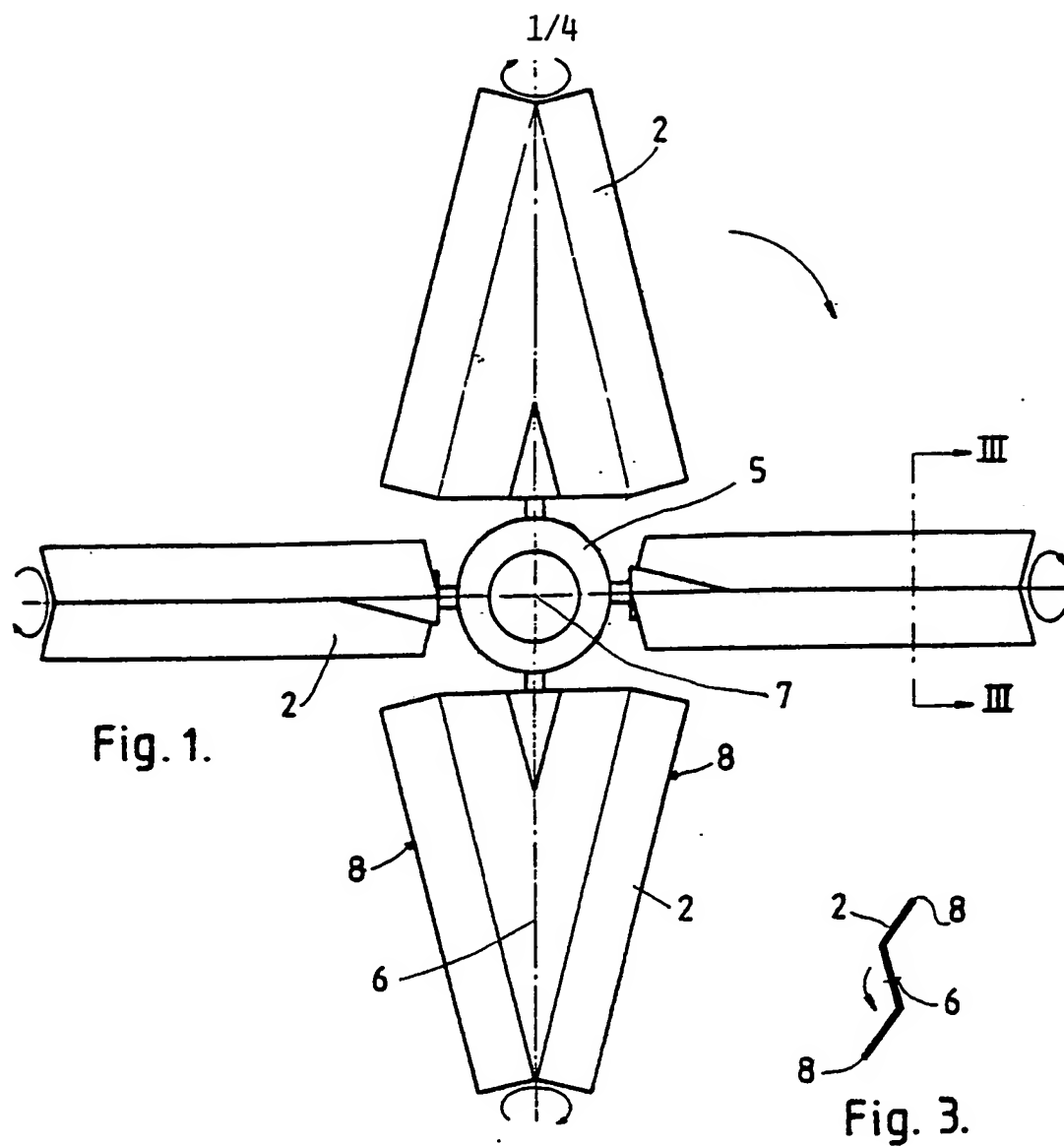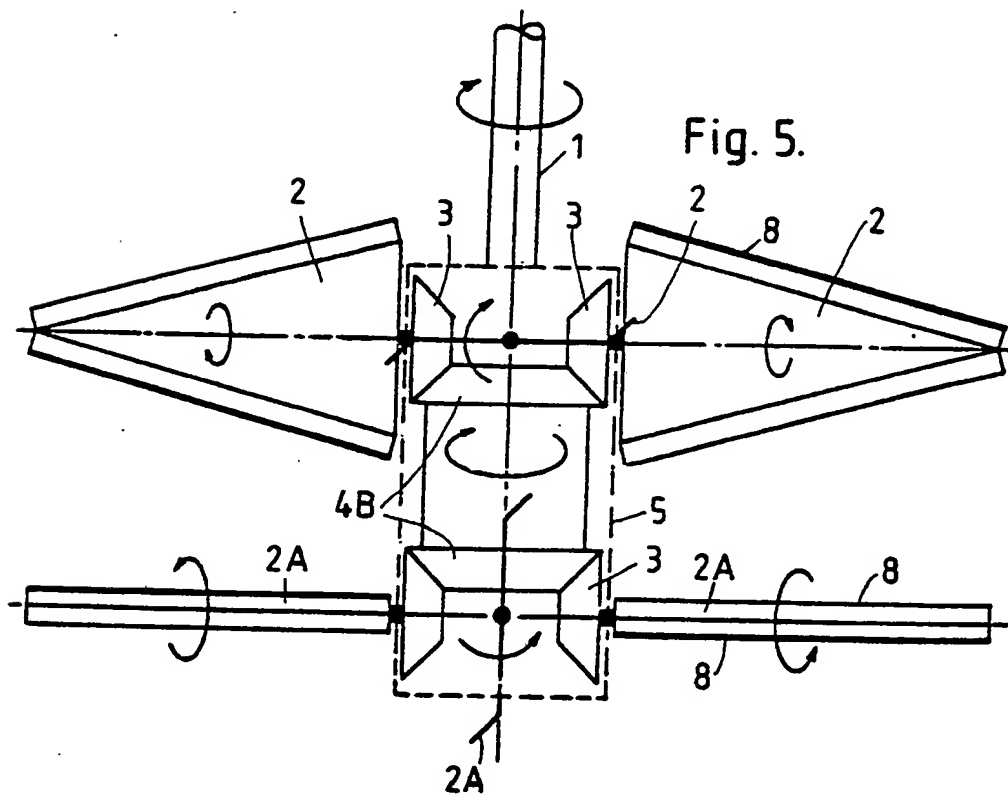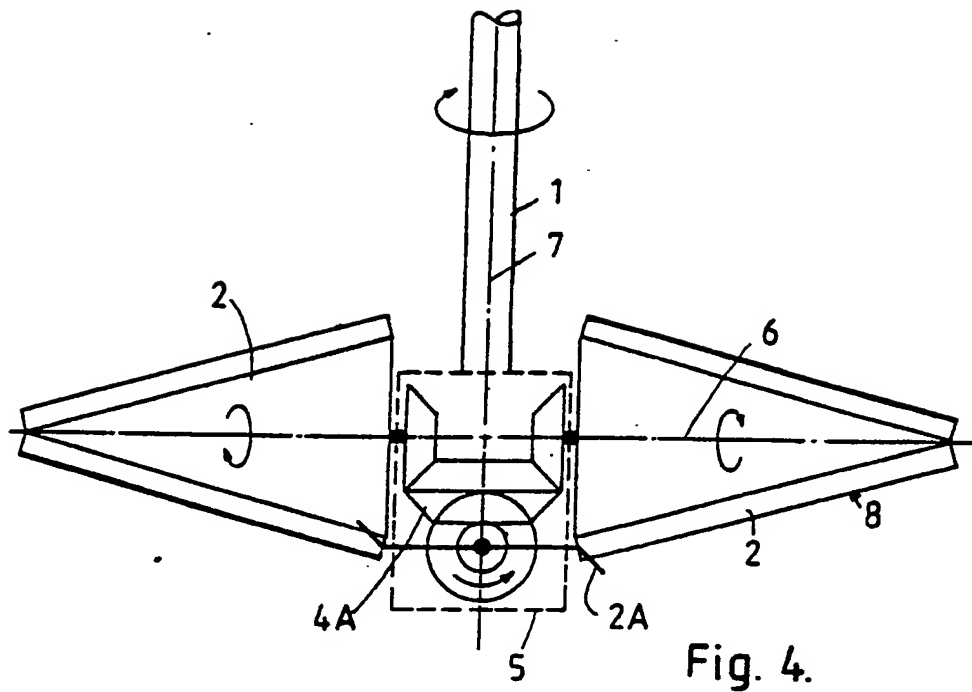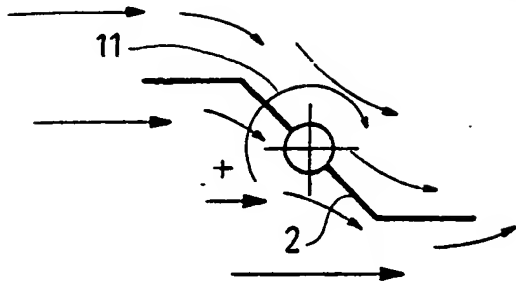
Fig. 8.
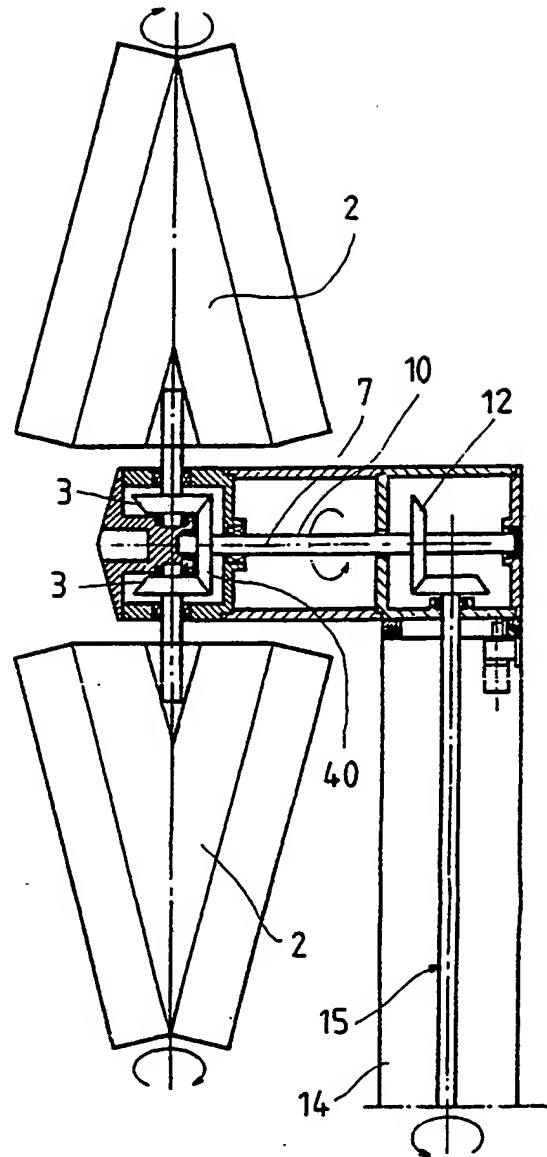
Fig. 7.
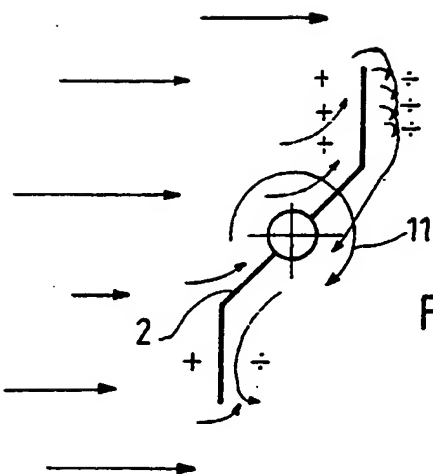
Fig. 9.
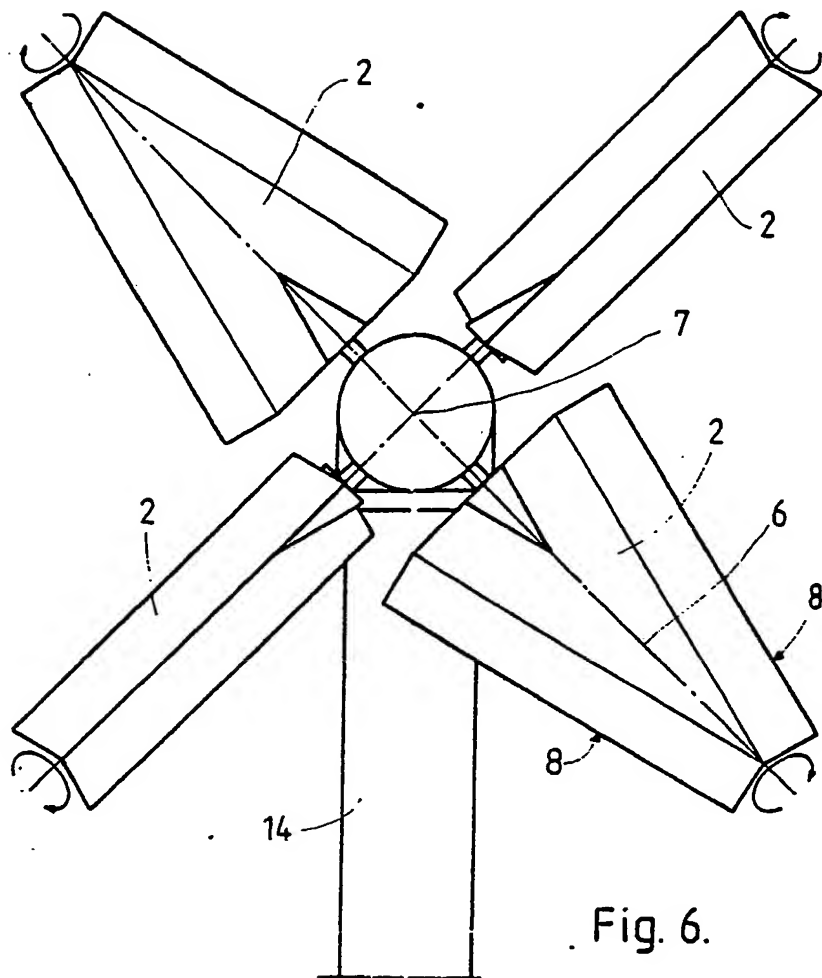
Fig. 6.
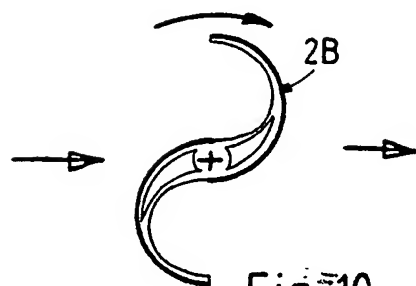
Fig. 10.
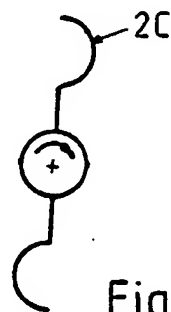
Fig. 11.

Fig. 12.

INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC 4

B 01 F 7/04, 7/18

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC 4	B 01 F 7/00-/06, /10, /16-/22, /26, 3/08-/18; B 28 C 5/12-/16
Nat Cl	80a:7/35, /40; 50f:2/30
US Cl	259:5-8,19,21-24,37,40-44,99,102,103,107,108, 112 .../...

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched 8

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
X	US, A, 1 479 584 (FRANK W CONKLIN) 1 January 1924 See fig 1 and 3	2
X	US, A, 2 905 451 (FREDERICK B CALLANEN) 22 September 1959 See fig 5 and 12	1, 4, 5
A	Derwent's abstract No 92 633 D/50, SU 812 329	1
A	Patent Abstracts of Japan, Vol 8, No 279, C257, abstract of JP 59-147627, publ 1984-08-24	1

* Special categories of cited documents: 10

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1987-12-03	1987 -12- 0 8

International Searching Authority	Signature of Authorized Officer
Swedish Patent Office	Wiva Asplund

Form PCT/ISA/210 (second sheet) (January 1985)

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II   <u>Fields searched</u> (cont)

<u>366</u>:64-66, 97-100, 241-261, 342, 343, 349

V.☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1] ·

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1.☐ Claim numbers _____, because they relate to subject matter not required to be searched by this Authority, namely:

2.☐ Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.☐ Claim numbers _____, because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI.☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1.☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4.☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (supplemental sheet (2)) (January 1985)